January 2022

Dynamically Adjusting Notification Alerts based on Device Position and User Activity

Joseph Turner

Stephen Norum

Dynamically Adjusting Notification Alerts based on Device Position and User Activity

ABSTRACT

Applications and services on mobile devices often generate notifications. Alerts are likely to be more effective if delivered at times when the user is in contact with the phone when stationary or while moving at a slow pace. This disclosure describes techniques that dynamically adjust the manner and/or time of notification alerts based on the current position of the device relative to the user and/or user activity, determined based on user-permitted data such as device sensor readings. The data is provided as input to a suitably trained machine learning model. The model indicates the likely position of the device in relation to the user, along with the likely user activity. Based on this information, the delivery mode and/or timing is dynamically adjusted. Implementation of the techniques can optimize the delivery of notification alerts, thus increasing the likelihood of catching the user's attention and enhancing the utility derived from the notification content.

KEYWORDS

- Notification delivery
- Device alert
- Activity detection
- Device position
- Timed delivery
- Gyroscope
- Accelerometer
- Contextual delivery

BACKGROUND

Applications and services on mobile devices often generate notifications containing content of interest to the user, such as incoming messages, status of fitness activities, tips of the day, etc. To seek the user's attention, such notifications are typically accompanied by one or

more alerts, such as sounds, vibrations, pop-ups, etc. Users can specify the manner in which they prefer to be alerted by notifications.

Currently, the default as well as user-specified manner in which the notification alerts occur does not take into account the position of the device relative to the user at the time of the alert. For instance, when users are not actively interacting with their mobile devices, they often carry the devices around with them by placing them in convenient places, such as pockets, purses, backpacks, etc. A user may feel a vibration alert when a device is placed in a pocket but is unlikely to notice vibrations when the device is in a backpack.

Even when users are interacting with the device, it might not be desirable to generate alerts at times when they are rushed and moving quickly. Instead, alerts are likely to be more effective and timely if delivered at times when the user is in contact with the phone when stationary or while moving at a slow pace.

DESCRIPTION

This disclosure describes techniques to dynamically adjust the manner and/or time of delivering notification alerts on a mobile device. With user permission, such dynamic adjustments are based on the current position of the device relative to the user and/or current user activity. With user permission, the current position of the device and user activity are inferred based on data obtained from permitted device sensors, such as gyroscope, accelerometer, etc.

The sensor data is provided as input to a suitably trained machine learning model. Based on the movement patterns and speeds inferred from the data, the model output indicates the likely position of the device in relation to the user, e.g., hand, pocket, backpack, desk, etc., along with the likely user activity, e.g., standing, walking, running, etc. For instance, cyclical patterns in the data can be associated with the device being in a pocket.

If a notification alert occurs at a time when the inferred device position and/or user activity is unsuitable for delivering the alert in its original mode, the alert mode is dynamically adjusted such that it is suitable for the inferred device position and/or user activity. For instance, a notification alert generated when the device is in the user's pocket can be delivered as a vibration instead of a sound. Alternatively, or in addition, notification alerts detected to be generated at inopportune moments based on the device position and/or user activity can be delayed until the device position and/or user activity are suitable for delivering the alert.

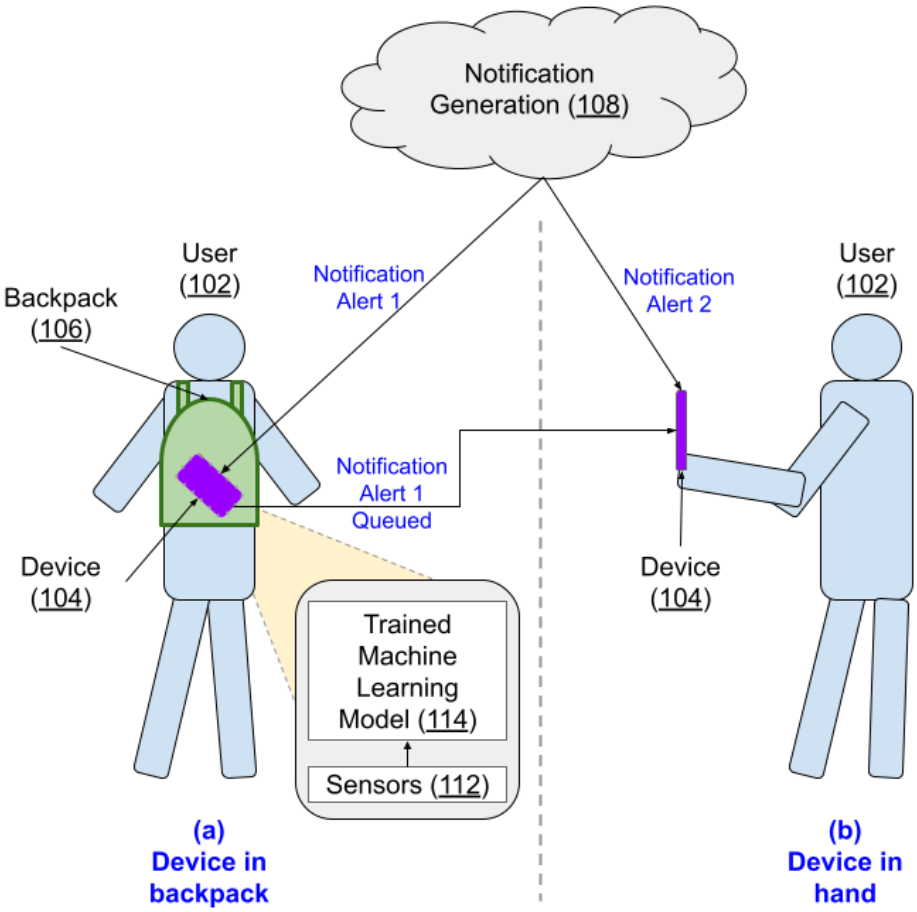

Fig. 1: Adjusting notification alerts for delivery at a more opportune moment

Fig. 1 shows an example of operational implementation of the techniques described in this disclosure. In Fig. 1(a), a user (102) has a device (104) in a backpack (106) when a

notification alert is received from a notification generation service (108) connected to an application on the device. With user permission, a trained machine learning model (114) is used to analyze data from the device sensors (112). The output of the model indicates that the device is in the backpack, thus making it unlikely that the user would notice the alert vibration or sound. The alert is then queued until the model output indicates that the device is in the user's hand. A second notification alert received while the device is in the user's hand is delivered immediately without queuing, as shown in Fig. 1(b).

With user permission, the content of the notification and the type of application or service connected to it can also be taken into account to determine how to deliver the alert. For example, notifications regarding directions from a navigation application are delivered even when a user is moving at a fast pace while those from an application requesting a user to review a location can be skipped if the user is detected to be running. If users permit, the techniques can be additionally applied to the display of advertisements such that advertisements are shown when users are likely to be receptive to the messages and are in a position to view and interact with the advertisements.

The techniques described in this disclosure can be applied to notification alerts for any application or service on mobile devices. The threshold values for the various model parameters used for inferring device position and user activity can be set by the developers and/or specified by users and/or determined dynamically at runtime. The techniques can be applied to notification alerts that are received from notification generation services external to the device as well as those generated by applications and services locally on the device. Implementation of the techniques can optimize notification alerts such that they are delivered at suitable moments, thus

increasing the likelihood of the alert catching the user's attention and enhancing the utility derived from the notification content.

Further to the descriptions above, a user may be provided with controls allowing the user to make an election as to both if and when systems, programs or features described herein may enable collection of user information (e.g., information about a user's apps and alerts, a user's activities, device sensor readings, a user's preferences, or a user's current location), and if the user is sent content or communications from a server. In addition, certain data may be treated in one or more ways before it is stored or used, so that personally identifiable information is removed. For example, a user's identity may be treated so that no personally identifiable information can be determined for the user, or a user's geographic location may be generalized where location information is obtained (such as to a city, ZIP code, or state level), so that a particular location of a user cannot be determined. Thus, the user may have control over what information is collected about the user, how that information is used, and what information is provided to the user.

CONCLUSION

This disclosure describes techniques that dynamically adjust the manner and/or time of notification alerts based on the current position of the device relative to the user and/or user activity, determined based on user-permitted data such as device sensor readings. The data is provided as input to a suitably trained machine learning model. The model indicates the likely position of the device in relation to the user, along with the likely user activity. Based on this information, the delivery mode and/or timing is dynamically adjusted. Implementation of the techniques can optimize the delivery of notification alerts, thus increasing the likelihood of catching the user's attention and enhancing the utility derived from the notification content.